

Webinar

Managing Aflatoxin Risk: Proper sampling and analytical techniques to ensure accurate and defensible results

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Feed the Future Innovation Lab for Livestock Systems, University of Florida













Proficiency Testing Reports

Sample Run: 1 v Aflatoxin: Total Platform: All Download Report Year: 2018 V

Total Aflatoxin in Cornmeal: January 2018 Sample (All)

Please use options menu above to view other reports

Assigned Mean: 49.2 µg/kg Assigned Standard Deviation: 12.4 µg/kg Average Range of Pairs: 2.8 µg/kg

100

80 -

Laboratory	Mean Result	Range	Bias	Z Value
1036	53.02	1.13	+3.82	+0.31
1039	49.00	0.00	-0.20	-0.02
1045	52.08	5.65	+2.88	+0.23
1048	50.55	4.73	+1.35	+0.11
1051	84.05	6.70	+34.85	+2.81
1057	47.90	0.47	-1.31	-0.11
1060	44.76	7.65	-4.45	-0.36
1066	40.46	0.05	-8.75	-0.71
1069	49.55	0.30	+0.35	+0.03
1072	46.10	3.18	-3.10	-0.25
1078	57.97	7.84	+8.77	+0.71
1084	41.50	2.40	-7.70	-0.62
1093	38.35	0.30	-10.85	-0.88
1099	48.43	0.87	-0.78	-0.06
1105	55.69	2.23	+6.49	+0.52
1117	15.08	0.10	-34.12	-2.75
1120	77.48	11.08	+28.28	+2.28
1129	33.69	14.04	-15.51	-1.25
1125	45.77	0.07	-2.44	-0.28

Managing Aflatoxin **Risk**

Proper sampling and analytical techniques to ensure accurate and defensible results

140.00

120.00

100.00

80.00 60.00 40.00

20.00 0.00

35







- Founded in 1899 Fertilizer Control Act and 1905 Feed Control Act
- Fee based agency currently 22 million tons of feed \$0.19 per ton inspection fee
- Exempt whole grain or whole seed not containing toxins or chemical adulterants
- Subchapter H. Adulterants(a)(6) B_1, B_2, G_1, G_2 above 20 ppb
- Feed Industry Memorandum 5-12 Originally Issued 15 Feb. 1991 Licensing, Labeling, Blending
- Feed Industry Memorandum 5-17 Originally Issued 22 Oct. 1991 Oilseeds/Processed Grains
- Feed Industry Memorandum 5-23 Originally Issued May 10 2011 Binding Agents
- One Sample Strategy Program (co-regulation) approved by the USDA Risk Management Agency



Pillars of Aflatoxin Risk Management

Connected & Transparent Marketplace

Public-Private Partnership with shared responsibility & mutual benefits



Laws, rules, standards & official methods; and Government-backed codes of practice or action plans





U.S. Department of Agriculture

Office of Inspector General Southwest Region

Audit Report

Risk Management Agency Crop Loss and Quality Adjustments for Aflatoxin-Infected Corn

Nationwide, in CY 2005, AIPs paid indemnities for Aflatoxin-infected corn totaling \$27 million, of which \$17.5 million was paid to Texas producers. For 394 of these claims in Texas, the OIG found that the AIPs accepted extremely low values (from \$.08 to \$.25) for infected corn, but that producers later sold this infected corn for prices between \$.80 and \$2.30 per bushel—between 5 to 28 times the value used to calculate the indemnity.



IN THE UNITED STATES BANKRUPTCY COURT FOR THE EASTERN DISTRICT OF TEXAS SHERMAN DIVISION

IN RE:

DORCHESTER GRAIN COMPANY

Case No. 10-40475 Chapter 7

Debtor(s)

NOTICE OF HEARING ON TRUSTEE'S MOTION FOR APPROVAL OF PROCEDURES FOR DETERMINATION OF RIGHTS, OWNERSHIP INTERESTS, LIENS, SECURITY INTERESTS AND ALL OTHER INTERESTS IN AND TO GRAIN AND PROCEEDS FROM SALE OF GRAIN AND THE MOTION TO SELL GRAIN FREE AND CLEAR OF LIENS, CLAIMS AND ENCUMBRANCES

SET FOR APRIL 28, 2010 AT 2:00 PM

NOTICE is hereby given that a hearing on the Motion for Approval of Procedures for Determination of Rights, Ownership Interests, Liens, Security Interests and All Other Interests in and



Variance Structure of Aflatoxin Contaminated Maize in Commercial Grain Elevators and Transporters

Variance Source	Percent of Total Variance
Facility	1.9
Bin	65.8
Truck	9.1
Sampling and Testing Error	23.2



Herrman et al. JRS 1(1):23-31



Highest Level of Aflatoxin in Corn Sampled & Tested by OTSC - 2010 Crop Year By County





JRS (2014) Volume 2: Issue 1 | pages 7-13



Journal of Regulatory Science



http://journalofregulatoryscience.org

Aflatoxin Sampling and Testing Proficiency in the Texas Grain Industry

Timothy J. Herrman^{a*}, Kyung-Min Lee^a, Benjamin Jones^a, Cynthia McCormick^a

Table 3. Descriptive statistics of proficiency sample test results from Texas grain elevators.

Aflatoxin control	Number of	Descriptive statistics				
(µg/kg)	measures (n)	Average (µg/kg)	Low (µg/kg)	High (µg/kg)	RSD $(\%)^a$	
52	38	50	2	102	45	
378	35	282	4	660	44	
580	28	488	64	1056	45	

^{*a*} RSD (%): relative standard deviation.



One Sample Strategy Components



Approved Equipment & Process

Management & Recordkeeping

Training for Individual Employees

Proficiency Verification Process Standardized methods

- Standardized training
- Verification of employee performance
- Documented program outcomes
- Monitoring & corrective actions
- Reduced market and food safety risk



United States Department of Agriculture	BULLETIN	NO.: MGR-17-015		
Farm Production and Conservation	TO:	All Approved Insurance All Risk Management A	Providers Agency Field Offices	
Risk		All Other Interested Par	ties	
Management	FROM	Heather Manzano	/s/ Heather Manzano	10/6/2017
CBelle A	I ROM.	Acting Administrator	15 Heamer Manzano	10/0/2017
1400 Independence				
Mail Stop 0801	SUBJECT:	One Sample Strategy fo	r Mycotoxins in Texas	
Washington, DC 20250				

BACKGROUND:

The Risk Management Agency (RMA) issued Manager's Bulletin MGR-11-011 on July 26, 2011, authorizing the "One Sample Strategy (OSS)" for aflatoxin testing in approved Texas elevator facilities for the 2011 crop year. The Bulletin stated RMA would annually reauthorize the program. RMA held discussions with the Office of the Texas State Chemist (OTSC), Regional Offices, and other interested parties and received written summary results from OTSC to determine whether to continue the program beyond the 2011 crop year. RMA issued Manager's Bulletin MGR-12-004 on April 12, 2012, authorizing the "One Sample Strategy" for aflatoxin testing in approved Texas elevator facilities for the 2012 and succeeding crop years.

ACTION:

For the 2017 and succeeding crop years, Approved Insurance Providers (AIPs) may consider OTSC-approved Texas grain elevator facilities to be approved laboratories for Mycotoxin testing for crop insurance purposes unless RMA or OTSC announces the succession of OSS. The OTSC will provide a list of participating elevator facilities they.



Chapter 2



The Laboratory

UNCERTAINTY & VARIABILITY











FGIS Design Criteria and Test Performance Specifications for Quantitative Aflatoxin Test Kits

Design and Performance

- Grinding and Homogenizing
- Sample Storage
- Reference Materials
- Standard Solutions
- Conditions of Analysis
- Written Instructions
- Time for Completion

Accuracy

- Minimum Range of Conformance
- Extended Range of Conformance
- Multiple Ranges of Quantitation
- Additional Commodities



Three analysts must each extract seven separate samples at each concentration according to the test kit instructions. Each analyst must use a separate test kit manufactured lot. All samples must be analyzed as if the concentrations were unknown.

At least 95% of the results (20 out of 21) for each concentration level must be within the acceptable ranges specified in Table 1. The acceptable range for each material will be adjusted using the mean concentration derived from the reference method analyses and the corresponding Maximum Relative Standard Deviation (RSD) from Table 1.

Table 1. Acceptable Limits					
Aflatoxins* (ppb)	Maximum RSD (%)	Standard Deviation (ppb)	Acceptable Range (ppb)		
5.0	25	1.25	2.5 – 7.5		
20	20	4	12 – 28		
100	16	16	<mark>6</mark> 8 – 130		
300	16	48	200 – 400		
* ± 15%					



Journal of Regulatory Science



http://journalofregulatoryscience.org

Aflatoxin risk management in Texas: test kit approval for maize

Table 2

Statistical results of validating test kits by comparing with reference HPLC results.

Aflatoxin levels (µg/kg) ^a	Statistical parameters	Kit 1	Kit 2	Kit 3	Kit 4	Kit 5	HPLC
59	Mean (µg/kg)	48	64	56	52	65	59
	RSD^b	0.16	0.13	0.15	0.13	0.15	0.13
	Accuracy $(\%)^c$	-17.8	7.9	-4.6	-12.1	10.9	
306	Mean (µg/kg)	266	312	293	284	301	306
	RSD	0.08	0.06	0.12	0.15	0.14	0.04
	Accuracy (%)	-12.9	1.9	-4.1	-7.3	-1.8	
901	Mean (µg/kg)	817	946	1199	799	829	901
	RSD	0.09	0.10	0.14	0.06	0.16	0.06
	Accuracy (%)	-9.3	5.0	33.0	-11.3	-7.9	

^a Aflatoxin concentrations determined by HPLC

^b RSD: relative standard deviation

^c Accuracy (%) = [(estimated-HPLC value)/HPLC value]x100



Uncertainty

ISO 17025 5.4.6.2

- Testing laboratories shall have and shall apply procedures for estimating uncertainty of measurement...
- Reasonable estimation shall be based on knowledge of the performance of the method and on the measurement scope and shall make use of, for example, previous experience and validation data

Uncertainty Budget

- List all potential factors affecting variability in measurements –make table
- Determine the standard uncertainty for each factor including distribution
- Perform root sum squares for all factors to create the combined or standard uncertainty

$$S_I = \sqrt{S_a^2 + S_b^2 \dots S_x^2}$$

Multiply by coverage factor: 2



OTSC Uncertainty Measurement Estimation

Analyte	Procedure	Mean	Std. Dev.	RSD	Uncertainty
Aflatoxin	HPLC	21.6	2.2	10.1	20.2
Aflatoxin	ELISA	24.6	3.7	15.1	30.2
Aflatoxin	LC/MS/MS	22.7	3.0	13.4	26.8
Aflatoxin	UHPLC	21.8	3.3	15.0	30.0
Aflatoxin	Fluoroquant	22.5	3.2	14.0	28.0
Fumonisin	LC/MS/MS	7.8	0.08	8.8	17.6



Chapter 3

Inference about the population

SAMPLING





Variance Structure of Aflatoxin Contaminated Maize in Commercial Maize Mills in Kenya

Variance Source ^a	F-value	p-value	Variance Component	Percent (%) of Total Variance
Mill	0.91	0.45	229.3	1.9
Truck	2.16	0.06	498.8	4.1
Bag	3.75	< 0.0001	7,360.5	60.8
In-bag	10.23	< 0.0001	3,221.3	26.6
Analysis	27.07	< 0.0001	762.5	6.3
Error			34.7	0.3
Total			12,107.1	100.0

Table 2: Variance of aflatoxin distribution by variance source.

^aValues presented in this table are obtained from both NESTED and GLM procedures of SAS.







Figure 1: Statistical power curve for the number of bags sampled per truck.



Criteria: Grinding

- Grind the entire sample
- Collect at least 500 grams of the ground sample
- 70% of the particles pass through a 20 mesh sieve after grinding





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J. Food Prot., Vol. 81, No. 4

FIGURE 1. Regression plot between a total number of particles in a 50-g sample vs the cumulative overs of a 20-mesh sieve (%).





Sample Grinding





Sample Grinding

















Chapter 4

REFERENCE MATERIAL

Developing uniform working controls





Creating Reference Material





Recommendation 9: Sufficient Homogeneity

In testing for sufficient homogeneity, duplicate results from a single distribution unit should be deleted before the analysis of variance if they are shown to be significantly different from each other by Cochran's test at the 99% level of confidence





Sufficient stability

Changes in test material are inconsequential

Period in question is the interval between preparation of the material and the deadline for return of the results

5 samples will be analyzed after the proficiency test





Control Chart

CONTROL

80 ppb Acceptable range 60 - 100 ppb







Chapter 5

PROFICIENCY TESTING



Proficiency Testing Reports

Options
 Year: 2018 ✓ Sample Run: 1 ✓ Aflatoxin: Total ✓ Platform: All ✓ Download Report

Total Aflatoxin in Cornmeal: January 2018 Sample (All)

Please use options menu above to view other reports

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123456				





APTECA Proficiency Testing Program

Corn Meal Sample #4



Proficiency Testing Performance





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 $\sigma = 2^{(1 - \log(C)/2)}$ Horwitz equation

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Z-score evaluation: $|z| \le 2.0$ Satisfactory 2.0 < |z| < 3.0 Questionable $|z| \ge 3.0$ Unsatisfactory

 $Z = (x - \mu) / \sigma$







URL: http://pt.tamu.edu/

			Testing	and Control	Program	, included a second s		
Home	About the Program	Register for the Program	F.A.Q.s	ISO-IEC Accreditation	Resources	Contact us	PT and Control in Africa	Purchas Referenc Material
oficiency Testing luding aflatoxin u 043:2010 and IS gible participants d educational ins	(PT) and Control Prog using the ELISA and F <u>60 17034</u> accredited f s include grain milling stitutions. The total n	gram in maize. The OTSG Flurometric Test Kits, HP for conducting proficienc and grain handling firm umber of participants is	is <u>ISO/IEC 1702</u> . LC, and UHPLC ar cy testing and pro s, feed manufactu limited to 300 pa	5:2005 accredited for c ad fumonisin using LCM ducing reference mater Iring industry, governme rticipants.	hemical testing, SMS, and <u>ISO/IEC</u> ial, respectively. ent laboratories	2019 Importan • Round 2 sam • Round 2 resu • Round 1 is clo	t Due Dates ples Shipping Date: Ilts Due: October 7, osed and results ha	Late-July, 2019 2019 ve been posteo
 Improve ov Facilitate la mycotoxin: Deliver a gi 	tives verall testing accura b adoption of a qu s. lobal aflatoxin profi	acy in participating lal ality systems approa iciency testing service	boratories ch to accurately e including the p	measure aflatoxin a roduction and sale o	nd other f aflatoxin	PT Participants • Setup your A • Data Entry P • View Reports • Feedback • Comments/S	ccount (First Time Us ortal ;	ser)













DISCLAIMER

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